Executive Office of Energy and Environmental Affairs
CLIMATE CHANGE ADAPTATION ADVISORY COMMITTEE

Meeting #2: July 30, 2009

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AAC1 – Meeting #2 Agenda

Executive Office of Energy and Environmental Affairs
CLIMATE CHANGE ADAPTATION ADVISORY COMMITTEE

Meeting #2: July 30, 2009

1:00 pm – 3:00 pm

1.	Introduction and Opening Remarks – David Cash	10 minutes
	Predicted Climate Change in Massachusetts (AAC4)	
2.	General Overview & Common Themes – Kathy Baskin	10 minutes
3.	Data/Information and Management – Christian Jacqz	10 minutes
4.	Sub-Committee Progress and Committee Discussion	75 minutes
	Coastal Zone and Oceans – Wayne Klockner Human Health and Welfare – Paul Epstein	
	Key Infrastructure – Edward Kunce	
	Local Economy and Government – Karen O'Reilly	
	Natural Resources and Habitat – Andrew Finton	
5.	Next Steps – David Cash	15 minutes

Future Advisory Committee Meetings:
September 9, 2009 from 1:00 pm – 3:00 pm
October 20, 2009 from 1:00 pm – 3:00 pm

AAC2 - Climate Change Adaptation 1st Advisory Committee Meeting Notes

I. Introduction and Opening Remarks

Meeting was called to order by David Cash, Chair, at 1:37 PM

David Cash welcomed everyone to the meeting, introduced Ian Bowles, Secretary of the Executive Office of Energy and Environmental Affairs (EEA). Secretary Bowles thanked everyone for giving their time and perspectives. He spoke of the magnitude of the change which faces our climate, and the changes we are likely to make in the years ahead. The charge to the committee is broad and large, and he asked us to take it very seriously. He added that we should "Look for bold and big ideas."

David Cash then asked the committee members to introduce themselves. Following that the individual subcommittee chairs as well as all others in the audience introduced themselves. There were close to 100 people in attendance. (See list of Attendees on Page 5)

II. Committee Overview

David Cash and Kathy Baskin discussed the subcommittee structure. Summaries of each subcommittee were distributed to the members.

David Cash reviewed the Committee Members' packet distributed the week before by email. (http://www.mass.gov/dep/public/committee/ccaac.htm)

III. Summary of Climate Change in Massachusetts

David Cash gave a power point presentation summarizing the predicted climate changes facing Massachusetts. (http://www.mass.gov/dep/public/committee/ccaac.htm)

Following the presentation, David Cash reviewed the charge to the committee with the members. The committee will review potential vulnerabilities related to climate change, analyze strategies for dealing with climate change, and look at the benefits of those strategies.

IV. Adaptation Discussion

The comments below are summaries of individual committee member and public participant statements.

Committee Overview

- Our charge is to review Massachusetts' impacts due to predicted changes in our climate.
- Prioritization of strategies is likely at some point, but does not fall within the responsibilities of this group at this time.
- There will be no new modeling undertaken within this project.

Subcommittee Roles and Coordination

- It is important to integrate and coordinate the work of the subcommittees. EEA will do so by monitoring subcommittee activities and fostering cooperation between subcommittee chairs.
- Coordination between the adaptation committee and the mitigation committee is critical, and EEA will facilitate this.
- If and when there are direct conflicts between mitigation and adaptation, each committee should note it in their report and the Secretary will ultimately decide the issue.

Strategy Design

- For consistency, all subcommittees should review climate change over a series of time periods in their assessments: 2020, 2050, and 2100.

- All subcommittees should also use the same predictions of climate change, to be provided by EEA.
- Given the uncertainty of localized climate models, subcommittees should be flexible in the scenarios they analyze and outline multiple scenarios to create smart strategies for an uncertain world. It is not necessary to get mired in the details of the predictions.
- As we develop our strategies, we need to look strongly at land-use issues.
- Don't forget to consider poverty-related issues, and socioeconomic risks surrounding issues such as infrastructure, emergency preparation, and human health.
- We recognize the need for ongoing long-term adaptive management, irrespective of whether that is the work of this group or of a subsequent oversight group formed upon the recommendation of this committee.
- As we develop our strategies, we must remember to keep our solutions broad-based. Highlight basic realities we might all face, but don't go too deep into the complexities.
- We need to pay some attention to low probability/high impact scenario items.
- Cost benefit analyses should be considered in qualitative terms.
- In designing strategies, subcommittees should consider how they might be funded.
- In addition to the costs of adaptation, which can be expected to be very expensive, we should also cite the costs of not adapting.

Public Outreach
- We should be sure to plan a public information session in the Boston area.
- We also need to consider political will. Such issues can often polarize the public. During the public process, involve legislators and local officials to be sure they are aware and have the opportunity to be involved.
- It will be important to fully explain what adaptation means during the public information sessions, and to focus on the shorter time horizon. The public responds better to 2030-2040; the end of the century is too far off.
- The term "adaptation" has not been well received among the public. Minimizing the use of that term is recommended, and "resilience" was suggested as an alternative.

Broader Considerations
- It is important to have federal involvement in and awareness of our efforts and, as such, the USEPA and USGS are participating.
- We should be sure to "cross-pollinate" between our areas of expertise and hear from people beside "the usual suspects" in each area.
- We need to keep regional considerations in mind, and should ensure coordination between the states on data, modeling, and strategy development. This is under the purview of the technical group advising the subcommittees and reviewing available data and models, recommending how best to store data available for all to share, and to review existing models which apply to the appropriate scale (statewide, New England region).
- Looking at other states' efforts will be key to this report.
- It would be convenient to have some subcommittee meetings held outside of Boston, or to at least have phone-in access.
- It could be helpful to include some case studies within the report as examples of climate change adaptation, to convey what it means to the public.

V. Next Steps

Following the discussion, next steps were discussed. David Cash reminded everyone that the timeframe is ambitious. Much work has already been done by the supporting staff. A climate change roadmap, developed last year by agency staff, will provide the starting point for our efforts. All members of the committee are encouraged to get involved.

A website has been established to keep everyone aware of meetings as well as materials under review (http://www.mass.gov/dep/public/committee/ccaac.htm).

Meeting #1 Attendees

NAME	AFFILIATION
ADVISORY COMMITTEE MEMBERS	
Ian Bowles	Massachusetts Executive Office of Energy and Environmental Affairs
David Cash, Chair	Massachusetts Executive Office of Energy and Environmental Affairs
Eugene Benson	Alternatives for Community and Environment (ACE)
Roseann Bongiovanni	Chelsea Green Space & Recreation Committee
Don Boyce	Mass Emergency Management Agency (MEMA)
Andy Cavanagh	UMass Extension, Amherst
Brian Fairbank	Jiminy Peak Mountain Resort
Melanie Fitzpatrick	Union of Concerned Scientists (UCS)
Hector Galbraith	Manomet Center for Conservation Sciences
Tim Griffin	Tufts University
Raymond Jack	Mass Water Works Association
Nathaniel Karns	Berkshire Regional Planning Commission
Paul Kirshen	Battelle Memorial Institute
Wayne Klockner	The Nature Conservancy
Bernie McHugh	Mass Land Trust Coalition
Alan Niederfringer	Travelers Insurance
Karen O'Reilly	Lexington Insurance Company
John Ramsey	Applied Coastal
Jeff Reade	AECOM
Bud Ris	New England Aquarium
Tamara Small	Commercial Real Estate Development Association
Carl Spector	City of Boston
Sandy Taft	National Grid
Peter Weiskel	United States Geological Survey (USGS)
Norman Willard	US Environmental Protection Agency – New England
PROXY ATTENDEES	
Michelle Manion (for Arthur Marin)	Northeast States for Coordinated Air Use Management (NESCAUM)
Taber Allison (for Laura Johnson)	Mass Audobon Society
Ryan Christenberry (for Paul Niedzwiecki)	Cape Cod Commission
STAFF	
Kathy Baskin, Project Manager	Massachusetts Executive Office of Energy and Environmental Affairs
Vandana Rao	Massachusetts Executive Office of Energy and Environmental Affairs
John Clarkeson	Massachusetts Executive Office of Energy and Environmental Affairs
Cassie Snow	Massachusetts Executive Office of Energy and Environmental Affairs, Intern
Craig Altemose	Massachusetts Executive Office of Energy and Environmental Affairs, Intern
Rebecca Gallagher	Massachusetts Executive Office of Energy and Environmental Affairs, Intern
Kira Sargent	Massachusetts Department of Environmental Protection, Intern

NAME	AFFILIATION
OTHER ATTENDEES	
John Bolduc	City of Cambridge
Brian Brodeur	Massachusetts Department of Environmental Protection
David Bryant	The Trustees of Reservations
Jack Buckley	Division of Fisheries and Wildlife
Margaret Callanan	Massachusetts Executive Office of Energy and Environmental Affairs
Jennifer Chamberlain	Massachusetts Executive Office of Energy and Environmental Affairs
Lisa Conley	Massachusetts House of Representatives: Committee on Climate Change
Andrea Cooper	Massachusetts Coastal Zone Management
Janet Curtis	Department of Energy Resources
Stewart Dalzell	Massport
Hope Davis	Division of Capital Asset Management
Yvette DePeiza	Massachusetts Department of Environmental Protection
Ellen Douglas	University of Massachusetts: Boston
Hunt Durey	Massachusetts Coastal Zone Management Wetlands Restoration Project
Steve Estes-Smargiassi	Massachusetts Water Resources Authority
John Felix	Massachusetts Department of Environmental Protection
Doug Fine	Massachusetts Department of Environmental Protection
Andy Finton	The Nature Conservancy
Adam Frank	City of Cambridge
Kate Garrett	Massachusetts State Senate: Global Warming Committee
Mary Griffin	Massachusetts Department of Fish and Game
Gerard Kennedy	Massachusetts Department of Agricultural Resources
Julia Knisel	Massachusetts Coastal Zone Management
Ed Kunce	Massachusetts Department of Environmental Protection
Tom Lamonte	Massachusetts Department of Environmental Protection
Andrea Langhauser	Massachusetts Department of Environmental Protection
Doug Levin	New England Clean Energy Council
Steve Long	The Nature Conservancy
Ann Lowery	Massachusetts Department of Environmental Protection
Steven Miller	Massachusetts Highway Department
Kyle Murray	Massachusetts State Senate: Global Warming Committee
Jessica Nordstrom	Massachusetts State Senate: Global Warming Committee
Adrian Ntwatwa	Conservation Law Foundation
Bob O'Connor	Massachusetts Executive Office of Energy and Environmental Affairs
John A. O'Leary	Massachusetts Department of Fish and Game

NAME	AFFILIATION
James Paterson	Massachusetts Department of Environmental Protection
Joe Pelczarski	Massachusetts Coastal Zone Management
Tom Philbin	Massachusetts Municipal Association
Martin Pillsbury	Metropolitan Area Planning Council
Tim Purinton	Massachusetts Department of Fish and Game Riverways Program
Claire Pywell	Massachusetts Water Resources Authority
Kayla Race	Massachusetts House of Representatives: Committee on Climate Change
Michael Raskin	Massachusetts Emergency Management Agency
Kira Sargent	Massachusetts Department of Environmental Protection
Seth Sheldon	University of Massachusetts: Boston
Jan Smith	Massachusetts Coastal Zone Management
Jessica Stanley	Massachusetts Highway Department Highway Design
Missy Stults	ICLEI - Local Governments for Sustainability
Brad Washburn	Massachusetts Coastal Zone Management
Jack Wiggin	University of Massachusetts: Boston Urban Harbors Institute
Stanley Wood	Massachusetts Highway Department Highway Design
Beverly Woods	Northern Middlesex Council of Government
Jonathan Yeo	Massachusetts Department of Conservation & Recreation, Office of Water Supply Protection
Rich Zingarelli	Massachusetts Department of Conservation & Recreation, Flood Hazard Mgmt. Project
Steve Zuretti	New England Power Generators Association

AAC3 - Advisory Committee Schedule

DATE	MILESTONES
June	
4	**1st CCAAC Meeting**
June 8 through Aug 15	Subcommittee Meetings (~ 3-4 meetings per subcommittee)
	Develop draft chapters
11	Public Information Session: Worcester, MA
24	Public Information Session: Barnstable, MA
30	Public Information Session: Wilmington, MA
July	
1	Public Information Session: Springfield, MA
2	Public Information Session: Lakeville, MA
15	Public Information Session: Boston, MA
16	Public Information Session: Dudley Square, MA
16	Public Information Session: Pittsfield, MA
30	**2nd Full CCAAC Meeting** Discuss subcommittee progress and comments received at public hearing sessions
August	
7	Subcommittee members submit components of drafts to subcommittee chairs
14	Subcommittee chairs deliver chapter drafts to EEA
September	
3	Chapter drafts to CCAAC members
9	**3rd Full CCAAC Meeting** Discuss chapter drafts
October	
5	Complete draft report, address comments from CCAAC; and distribute to CCAAC
20	**4th Full CCAAC Meeting** CCAAC offers final comments on draft final report
November	
	Internal EOEEA report review
December	
15	Report delivered to printer for production
31	Report delivered to the Legislature

AAC4 - Climate Change Scenarios for the Northeast

It is generally accepted by the scientific community that the increased amount of anthropogenically generated greenhouse gas emissions (for example from industrial processes, fossil fuel combustion, and changes in land use, such as deforestation) over the last century is responsible for changing climatic conditions, and that these changes are expected to continue even as we succeed in curbing our emissions. There is already evidence that the heating of our atmosphere from greenhouse gases is responsible for changes in many of the earth's natural climatic features such as increasing surface, air, and ocean temperatures, variation in precipitation, greater storm intensity, sea level rise, changes in water availability, increased length of the growing season, shifts in species types and ranges, more frequent floods and droughts, and greater heat intensity. The ongoing debate in the scientific community is not <u>if</u> but <u>when</u> climate change will occur, the <u>extent</u> to which climate change will occur, and the range of adjustments that will need to be taken to address potential or ongoing impacts of climate change.

As a coastal state, Massachusetts is particularly vulnerable to climate change impacts. According to the Pew Center on Global Climate Change (2007), relatively modest changes in temperature can have major impacts on already stressed coastal ecosystems threatening biodiversity and ecosystem-based economies, such as fisheries, tourism, and recreation. Additionally, Massachusetts is expected to experience a significant impact to its vast coastline due to sea level rise. All of the scenarios of partial or complete melting of ice caps in Greenland and Antarctica threaten to increase sea level along Massachusetts and inundate expensive and highly populated coastal areas.

Massachusetts is also expected to experience an increase in temperature. Scientists predict that Massachusetts will experience a lengthening of the growing season; more short-term droughts; and an increase in precipitation rates, especially during the winter months by mid-century. The duration of winter snow season could be reduced by half. By 2050, Boston could experience the current 100-year flood every 2-3 years on average and by 2100 the current 100-year flood is expected to occur every 1-2 years in both the low and high emissions scenarios. In the case of coastal storms, the frequency and timing of nor'easters could change. Under the low emissions scenario there is predicted to be little change in the number of nor'easters striking the Northeast; but under the high emission scenario, the Northeast could experience about 5-15 percent more late-winter storms. Lastly, global warming, which in turn increases sea temperatures, could potentially increase hurricane intensity. The debate on this issue within the scientific community is still ongoing.

In characterizing future climate change, we recognize that scientific predictions are fraught with uncertainty. We cannot predict the levels of future greenhouse gases emissions world-wide. We also cannot predict which model will most closely characterize future climatic conditions. Nevertheless, we have compiled recent, peer-reviewed scientific projections to enable the advisory committee to fulfill its mission of analyzing strategies for adapting to the *predicted impacts of climate change in the commonwealth*. Scientists agree that these projections will be updated over time as our understanding of climate changes and our ability to simulate them improves. While the following predictions of climate change appear precise (many are presented with three significant figures), we know that the uncertainty associated with these predictions is high and that these predictions will change over time. Therefore, we present this information as a starting point in our discussion – to give us a general understanding of the types of changes that we might anticipate, and the extent to which these changes might occur.

The tables below provide a summary of the expected changes over the next century. The extent to which we must adapt to these changes will depend on the extent to which we are able to decrease the amounts of greenhouse gases being introduced into the environment.

SEA LEVEL RISE PREDICTIONS*

Sea-level projections for the 21st century are evolving rapidly. The scientific understanding of past, current, and future changes in global and regional climate that drive sea-level change is improving. The following is a brief summary of the predictions and the several factors that will contribute to sea-level rise (SLR) in Massachusetts over the next century.

Sea-Level Rise	Projections by 2050		Projections by 2100		
(centimeters)	2050 Low	2050 High	2100 Low	2100 Mid	2100 High
Pfeffer et al 2008	-	-	79	83	201
Rahmstorf 2007	20	40	50	80	140
IPCC 2007 (Meehl et al)	-	-	21	48	59
Current sea-level trend	16		29		

Subsidence

The Boston tide gauge dates to 1921. The linear trend in relative SLR (RSLR) from 1921-2006 is 2.63 +/- 0.18 mm/yr. Over that same time period, the global rate of SLR was about 1.7 mm/yr (IPCC, 2007). Thus, there is about 1 mm/yr subsidence in the local RSLR record. This rate of subsidence is also supported by recent compilations of Late Holocene sea-level data, historical tide gauge data, and modeling of isostatic adjustment for the Atlantic coast (Engelhart et al., in press).

Global eustatic SLR

The project relies three published, credible projections for SLR out to 2100:

1) IPCC (2007) (18-59 cm by 2100)
2) Rahmstorf (2007) (50-140 cm by 2100)
3) Pfeffer et al. (2008) (78-201 cm by 2100)

The IPCC (2007) projections are widely viewed as too conservative (e.g., Rahmstorf et al., 2007; Jevrejeva et al., 2008). Nonetheless, they are highly credible and internationally recognized. The Rahmstorf approach uses a semi-empirical relationship between global mean surface temperature and sea-level, then projects future changes using the IPCC TAR (IPCC, 2001) temperature scenarios. Pfeffer et al. use the IPCC (2007) steric projection, and then adds ice melt based on what the authors believe to be physically plausible melt/deterioration rates for Greenland, Antarctica and other glaciers and ice caps, based on different rates of melt/discharge that are known from ice sheet and glacier behavior.

Regional dynamic SLR

Two recent papers (Yin et al., 2009; Hu et al., 2009) suggest that the northeastern U.S. may experience additional SLR above the global mean due to changes in the strength of the Atlantic Meridional Overturning Circulation (AMOC – the Gulf Stream is part of the AMOC system). As the AMOC slows, the dynamic topography of the sea surface changes and one result is that sea-level rises at the coast. Yin et al. suggest the potential for an additional 15-27 cm sea level rise for Boston by 2100. Hu et al. suggest sea level rise of 10-30 cm for the northeastern U.S. by 2100.

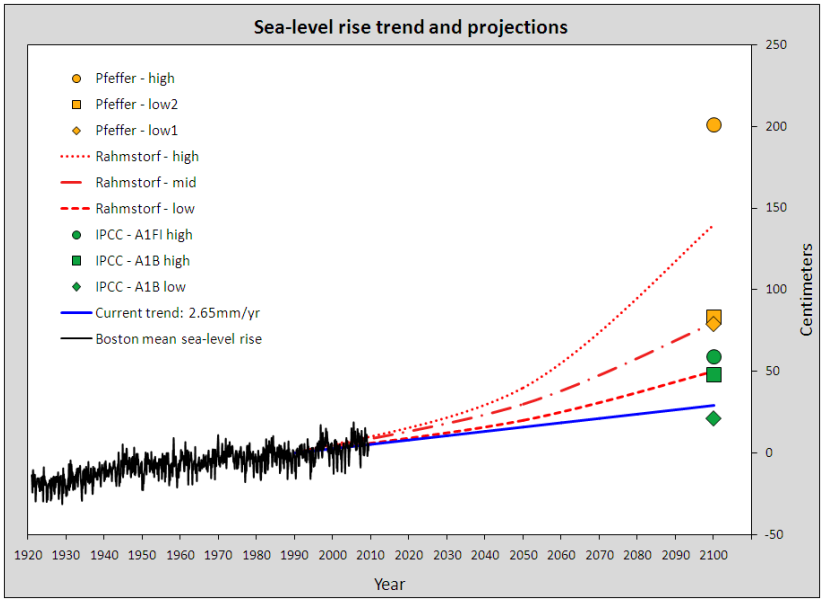
Gravitationally-induced SLR

A recent paper by Bamber et al. (2009) found that the collapse of the West Antarctic Ice Sheet (WAIS) not only adds to SLR, but also causes a redistribution of ocean mass due to the reduced gravitational attraction of the smaller WAIS. This is a global effect, and is most pronounced in a band at ~40° north latitude where the sea-level rise is about 25 percent more than elsewhere around the globe. Coastal Massachusetts extends from roughly 41°10'N to 42°53'N and therefore would experience essentially the full magnitude of this impact. There is presently high uncertainty regarding the potential for full WAIS collapse, but the effect also applies to partial collapse.

** Our thanks to Rob Thieler of the USGS Woods Hole Science Center, Paul Kirshen from Battelle and Ellen Douglas from UMass Boston for this compilation.*

Graphical representations of potential future SLR

The figure below provides a summary of the global projections described above.



OTHER NORTHEAST CLIMATIC CHANGES

Parameter	Current (1961-1990)	Predicted Range of Change by 2035-2064	Predicted Range of Change by 2100
Annual Temperature[4] (° C)	7.8	2.1 to 2.9	2.9 to 5.3
Over 90° F (32.2 ° C) temperature[18] (days)	5 to 20	--	30 to 60
Over 100° F (37.7 ° C) temperature[18] (days)	0 to 2	--	3 to 28
Ocean pH[7, 10]	7.0 to 8.4	--	-0.14 to -0.35*
Annual Sea Surface Temperature (° C)[12]	11.9	1.68 (in 2050)	4.4[18]
Annual Precipitation[4]	102.9 cms	5% to 8%	7% to 14%
Winter Precipitation[4]	20.95 cms	6% to 16%	12% to 30%
Summer Precipitation[4]	28.03 cms	-1% to 3%	-1% to 0%
Streamflow - spring peak flow[4] (days)	84.5	-5 to -8	-11 to -13
Droughts lasting 1-3 months[4] (#/30 yrs)	12.61	5.12 to 7.19	3 to 9.99
Droughts lasting 6+ months[4] (#/30 yrs)	0.03	0.03 to 0.11	0.04 to 0.39
Snow Days/Month (days)[4]	5.2	-1.7 to -2.2	-2.4 to -3.8
Length of growing season [4] (days)	184	12 to 27	29 to 43

Note that typically the lower number of the ranges above reflects the minimum of the 'lower emission' scenario, and the higher number in the ranges above reflects the maximum of the 'higher emission' scenario as outlined by the IPCC.
Lower emission = CO_2 concentration at 550 ppm; Higher emission = CO_2 concentration at 970 ppm
* Global data

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AAC5 – Climate Change Vulnerability Assessment– Sample Table

CLIMATIC PARAMETER	ASSETS of CONCERN in the ENERGY SECTOR			
	LNG and other Production & Ancillary Equipment and Facilities	**Underground Gas Transmission Lines & Ancillary Equipment**	**Underground Gas Distribution Lines & Ancillary Equipment**	**Power plants and Ancillary Equipment**
SEA LEVEL RISE/FLOODING (permanent or frequent inundation, 100-Year flood, saltwater intrusion/infiltration, enhanced storm surge, changing groundwater flows)	**Priority** - High **Impact** - High, equipment damage, limited access, interruption of peakshaving service **Implications** - reliability degradation, possible customer outages during winter, replacement of damaged assets **Short-Term Strategies** - analysis of vulnerabilities, install temporary protection such as dikes/pumps, structural bracing **Long-Term Strategies** - determine if asset is required, redesign with more permanent protection such as raising component, new structural design or complete relocation	**Priority** - High **Impact** - High **Implications** - the asset may need to be replaced and there could be a loss of service in the interim **Short-Term Strategies** - monitor, may need to add weight coating to the pipe **Long-Term Strategies** - Replace or elevate facilities as necessary (compressor stations)	**Priority** - High **Impact** - High **Implications** - distribution lines could flood in low lying areas. Service loss will occur if flooding is severe. Service loss will occur if outside meters are flooded **Short-Term Strategies** - Monitor **Long-Term Strategies** - elevate meter locations to protect against flooding	**Priority** - varies by site; high priority for coastal plants **Impact** - varies by site; may cause temporary flooding of certain sites **Implications** - varies by site; flooding and storm surges may cause damage to existing infrastructure, which can ultimately affect the overall system reliability within the region **Short-Term Strategies** - educate and work with asset owners on the type of data that may be useful for future planning; monitoring/data collection to identify which sites are at risk **Long-Term Strategies** - consider new areas within the state for siting new capacity
INCREASING TEMPERATURE (higher annual average temp, more hot days (over 90 and 100°F), more frequent and intense heat waves, higher heat index, warmer winters, warmer water temps, fewer cold air outbreaks, earlier snowmelt, longer growing season)	**Priority** - Low **Impact** - Medium **Implications** - medium, warmer winters could negate need for peak shaving **Short-Term Strategies** - analyze gas supply needs based on warmer winters **Long-Term Strategies** -revise peak day gas supply plan	**Priority** - Low **Impact** - **Implications** - **Short-Term Strategies** - **Long-Term Strategies** -	**Priority** - Low **Impact** - None **Implications** - **Short-Term Strategies** - **Long-Term Strategies** -	**Priority** - moderate **Impact** - increased residential/industrial demand; plant efficiency can be affected by higher temperatures **Implications** - increase in load served **Short-Term Strategies** - educate and work with asset owners on the type of data that may be useful for planning; monitoring/data collection to identify which sites may or may not be at risk, encourage consumer energy efficiency **Long-Term Strategies** - incorporate Smart grid capability, increase capacity at existing plants; encourage new plant construction if necessary
CHANGING PRECIPITATION (increased annual precip, increased winter precip, less summer precip, reduced streamflow, more droughts, fewer snow days)	**Priority** - Low **Impact** - Low **Implications** - increased maintenance costs **Short-Term Strategies** - provide temporary enclosures **Long-Term Strategies** - enclose equipment in permanent enclosures or more robust equipment	**Priority** - Low **Impact** - None, unless conditions arise as described in "Sea level rise" **Implications** - **Short-Term Strategies** - **Long-Term Strategies** -	**Priority** - Low **Impact** - None, unless conditions arise as described in "Sea level rise" **Implications** - human factor issues (ability to work) **Short-Term Strategies** - **Long-Term Strategies** -	**Priority** - low **Impact** - droughts could impact small-scale hydro and pump storage **Implications** - reduced output, localized flooding **Short-Term Strategies** - conduct research on the site specific effects that have occurred from precip. fluctuation **Long-Term Strategies** - use research to determine longer-term strategy, evaluate site location
EXTREME EVENTS (increased wind loads, higher storm surges, higher wave height, more ice storms or freezing rains)	**Priority** - High **Impact** - High, equipment damage, limited access, interruption of peakshaving service **Implications** - reliability degradation, possible customer outages during winter, replacement of damaged assets **Short-Term Strategies** - analysis of vulnerabilities, install temporary protection such as dikes/pumps, structural bracing **Long-Term Strategies** - determine if asset is required, redesign in place with more permanent protection such as raising component, new structural design or complete relocation, ensure LNG supply available during EWEs, prepare for LNG as short-term supply during EWEs	**Priority** - High **Impact** - Damage to supply source(s) **Implications** - Loss of supply, impacting fuel sources for electric generation **Short-Term Strategies** - Monitor **Long-Term Strategies** - Ensure geographic diversity of supply and storage	**Priority** - Low **Impact** - Equipment damage from ice storms/hurricanes **Implications** - loss of service, extra time to restore **Short-Term Strategies** - monitor; plan for emergency backup power **Long-Term Strategies** - asset hardening, increase emergency preparedness	**Priority** - High **Impact** - Potentially damaged infrastructure **Implications** - damages to facilities can potentially affect overall reliability of region **Short-Term Strategies** - educate and work with asset owners on the type of data that may be useful for planning; monitoring/data collection to identify which sites may or may not be at risk **Long-Term Strategies** - take steps to fortify facilities deemed vulnerable (berms, storm walls etc.), consider new areas within the state for siting new capacity

AAC6 – Brief Overview from each Sub-Committee

COASTAL ZONE AND OCEAN SUBCOMMITTEE

Chair: Bruce Carlisle, Office of Coastal Zone Management
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Sectors and Issues Addressed

- Coastal habitats/resources: coastal dunes/beaches/banks, inter-tidal marshes, flats, rocky shores, tidal estuaries.
- Ocean habitats/resources: marine bays, sounds, and ocean habitats, the ecosystem services they provide.
- Public structures & critical facilities: roads, railways and subways, seawalls, energy and telecomm. utilities.
- Residential & commercial development: homes, roads, docks, seawalls, and commercial/industrial, businesses.
- Ports & harbors: commerce, shipping, transportation, infrastructure, docks/piers, boat ramps; and shipyards.
- Public access & tourism: public beaches, open space, walkways/harbor walks, historical/heritage areas.

Potential Vulnerabilities Identified

- Decreased primary and secondary production and cascading trophic effects.
- Loss of suitable habitat and critical life-stage support for ecologically important marine and estuarine species.
- Damage and loss of public and private development, infrastructure, critical facilities, port assets due to severe coastal shoreline erosion.
- Damage and loss of public and private development, infrastructure, critical facilities, port assets due to overwash and breeching of barrier beaches.
- Damage and loss of public and private development, infrastructure, critical facilities, port assets due to inundation from increased storm surge and inland flooding.
- Loss of/drowned inter-tidal estuarine marsh habitat due inability of marsh accretion and soil formation to keep pace with rapid sea level rise and compounded by limitation of landward migration.
- Shifts in location and productivity and loss of commercial and recreational fisheries due to loss of suitable habitat and critical life-stage support for commercially important marine and estuarine species.
- Loss of commercial fishing and aquaculture revenue due to shellfish impacts from reduced shell formation and reproduction/growth rates.
- Loss of commercial fishing and aquaculture revenue due to shellfish diseases and pathogens.
- Degradation and loss of freshwater drinking water supplies through increased saltwater intrusion into groundwater aquifers.
- Increase in adverse human health effects and degraded estuarine and marine water quality due to increases in polluted run-off and CSO events.
- Loss of commercial fishing and aquaculture revenue and adverse human health effects due to increases in harmful algal blooms.
- Loss of tourism revenue and recreational opportunities due to eroded beaches, increase in nuisance and harmful algal blooms and fish-kills, and decreased public waterfront and water access.

Common Themes

Sea-level rise is over-arching driver for coastal zone vulnerabilities, and there is widespread, strong desire for best available science to develop regional projections to guide adaptation planning and management.

Include ecosystem services in comprehensive climate change vulnerability assessments.

As a home-rule state, communities may seek support to engage in longer term analyses, decision-making about new and re-development, public safety, managed retreat, engineered solutions, and the associated risks and costs.

There are key science and technology gaps that if filled can enhance our understanding of risk and vulnerability and options for increasing resiliency.

Options for adaptation strategies in the marine (or ocean) environment may be more limited than terrestrial areas.

Fiscal tools such as grants, loans, investments, real estate disclosures, and insurance may provide important incentives and disincentives

Data Gaps

- High-resolution topographic and bathymetric data: For the vulnerabilities listed above (and more), high-resolution topographic and bathymetric elevation data could provide baseline information for establishing important, highly-accurate digital terrain models which can be coupled with region-specific tide data, sea level rise projections, hydrologic models, and other key parameters to identify the areas, facilities, and resources most vulnerable to potential climate change impacts.
- Regional/local sea-level rise, storm surge, and shoreline change projections: Coastal states could benefit from more detailed and complex models that incorporate embayment-scale changes in coastal geomorphology, hydrological conditions, and human alterations and responses (e.g., seawalls and beach nourishment) to more adequately assess vulnerabilities of climate change and benefit from the development of uniform methods for modeling local-scale shoreline changes associated with varying sea level rise projections.
- Risk maps for current and future velocity and flood zones: Development of accurate floodplain mapping and real-time flood response capabilities has value. Hydrological and hydraulic engineering models of flooding and would support the identification of areas at risk, and planning for protecting property and emergency response and assistance.
- Monitoring, assessment, and modeling for key/rare/vulnerable habitats, ecologically and commercially important species, and threshold responses: Maintaining and augmenting current monitoring, assessment, and modeling efforts could support a solid understanding of key biotic and abiotic ecosystem components and their response to/impacts from the effects of climate change. Continue investigations to increase our understanding of critical species, community, and/or trophic thresholds (e.g., shifts in primary/secondary production and ocean circulation/hydrodynamics; effects of pH, temperature, and salinity changes on organisms; and long-term changes in the frequency of intense storms).

Overlap with other Subcommittees

Since the issues of the other subcommittees (e.g., Natural Resources and Habitat, Local Economy, Key Infrastructure, Human Health and Welfare…) are not mutually exclusive in the Coastal Zone, there is significant overlap with other groups and the Coastal Zone and Ocean Subcommittee. Rather than spend valuable time carefully orchestrating what each group would and would not cover, it was decided that if overlap occurred, it would not be detrimental, but instead amplify and augment vulnerabilities and strategies that are jointly identified.

Overlap with GWSA Mitigation

EEA implementation of global warming policy and regulations, including cost effectiveness, societal benefits, and impacts on low-income communities can further assist in identifying vulnerable communities and feasible adaptation strategies. The goals of the Global Warming Solutions Act are to both combat climate change and reduce the burden of adaptation.

An enforceable statewide GHG emission limit for 2020 promotes climate change adaption strategies to reduce impervious surfaces and vehicle trips, such as compact design, transfer of development rights, and low impact development.

Coastal Zone and Oceans Subcommittee Participants

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Jim Sprague	Massachusetts Department of Environmental Protection
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Jack Wiggin	University of Massachusetts, Urban Harbors Institute

* member of the Advisory Committee

AAC6 – Brief Overview from each Sub-Committee

HUMAN HEALTH & WELFARE SUBCOMMITTEE

Co-Chairs Name: Ann Lowery, DEP Email: ann.lowery@state.ma.us
Name: Michael Celona, DPH Email: mike.celona@state.ma.us

Sectors and Issues addressed

- Public Health
- Air Quality
- Water Quality
- Agriculture and Food Supply
- Vulnerable Populations
- Cultural Resource

Potential Vulnerabilities Identified

- Public Health: Increased heat stress, cardiopulmonary complications in those with asthma and cardiac diseases, and transmission of mosquito and tick-borne illnesses due to higher annual temperature and more frequent and intense rainstorms
- Indoor Air Quality: Indoor air-related health concerns (e.g., exacerbation of pre-existing asthma or allergies) from water damage and mold due to flooding
- Outdoor Air Quality: Outdoor air-related health concerns due to ozone and particulate matter trapped at the ground level by extreme heat events and resulting outdoor activity restrictions
- Water Quality: Increased vulnerability to health effects from contamination of drinking water quality due to more frequent and intense rainstorms and flooding impacting ground and surface water supplies.
- Agriculture and Food Supply: Shifting crop patterns and agricultural damage due to an increase in the population of existing agricultural pests and introduction of new pests due to higher annual temperature, potential increased use of pesticides
- Vulnerable Populations: Children and elderly as well as people with limited resources and pre-existing health conditions could bear a heavier burden of health impacts exacerbated by climate change due to lack of resources, such as available cooling or adequate health care, and ability to recover from extreme weather events. Populations living in coastal areas and in flood zones can also be more seriously affected. "Climate refugees" may also tax our social resiliency, and coastal residents may move inland.
- Cultural Resources: Loss or damage of recreational areas, archeological sites, historical buildings and their contents, and cultural facilities such as libraries due to sea level rise and flooding

Common Themes and Data Gaps

- The impacts of climate change could be most pronounced on vulnerable populations (described above). Mapping and understanding the specific vulnerabilities should be refined.
- The specific impacts of climate change vary broadly on human and geographic vulnerability.
- Local and state officials to review resource priorities, information and support in order to respond
- Additional and enhanced surveillance as well as responses to illnesses related to climate change (e.g., asthma, heat stroke, Lyme disease) and air and water quality health impacts

Overlap with other Subcommittees

- Public Health and Cultural Resources affect Coastal Zone & Ocean, Key Infrastructure, and Local Economy
- Air Quality, Water Quality, and Agriculture and Food Supply affect Natural Resource & Habitat, Key Infrastructure, and Local Economy
- Vulnerable Populations affects Key Infrastructure and Coastal Zone & Ocean, and Local Economy & Govt.

Overlap with Global Warming Solutions Act Mitigation Advisory Committee

- Evaluate health and environmental impacts of mitigation alternatives.

Human Health & Welfare Subcommittee Participants

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Ann Lowery (co-chair)	Massachusetts Department of Environmental Protection
Michael Celona (co-chair)	Massachusetts Department of Public Health
Neenah Estrella-Luna	Alternatives for Community and Environment
Yana Garcia	Alternatives for Community and Environment
Gene Benson	Alternatives for Community and Environment
Roseann Bongionvanni	Chelsea Greenspace and Recreation Committee
Leon Bethune	City of Boston, Environmental Health Office
Gregor Trinkaus-Randall	Co-Step
Beth Wade	Co-Step/ Bd. Of Library Commissioners
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Sean Bowen	Massachusetts Department of Agricultural Resources
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Michael Hutcheson	Massachusetts Department of Environmental Protection, ORS
Yvette DePeiza	Massachusetts Department of Environmental Protection, Drinking Water Program
Peter Judge	Massachusetts Emergency Management Agency
Jeffrey Trask	Massachusetts Emergency Management Agency
John Graham	Northeast States Center for a Clean Air Future
Arthur Marin	Northeast States Center for a Clean Air Future
Cathy Brown	State Veterinarian
Timothy Griffin	Tufts University

AAC6 – Brief Overview from each Sub-Committee

KEY INFRASTRUCTURE SUBCOMMITTEE

Co-Chairs: Ed Kunce, Mass DEP edward.kunce@state.ma.us
Ron Killian, Mass Turnpike ronald.killian@masspike.com

Sectors and Issues addressed

- Air and Sea Transport
- Built Infrastructure and Public Buildings
- Dam Safety and Flood Control
- Energy
- Public Safety
- Public Water Supply
- Rail and Public Transit
- Roadway System
- Solid and Hazardous Waste
- Stormwater
- Telecommunications
- Wastewater

Potential Vulnerabilities Identified

- As a state with many densely populated areas along the coast and major river systems, many of MA's key infrastructure resources may be threatened by multiple climate change impacts
- Increased damage potential from storm surge
- Increased summertime energy demand combined with heat stressed electrical equipment
- Extreme weather conditions are predicted to occur more frequently and with greater intensity, possibly leading to more situations similar to the December 2008 Ice Storm or the 2006 Mother's Day floods
- Increased hydraulic loads to wastewater and stormwater collection and treatment systems, leading to increased numbers and volumes of sanitary sewer overflows (SSOs), combined sewer overflows (CSOs), and backup of sewage into homes and businesses
- Current stormwater systems are likely to be inadequate for managing future events
- Public and private groundwater-based water supplies could be contaminated by salt water intrusion from sea level rise (SLR), storm surges, and coastal flooding
- Existing building practices, materials, and codes may not adequately address predicted climate change impacts, including flooding, ice storms, thermal stress, heat waves, and enhanced mold conditions

Common Themes and Data Gaps

- Lack of accurate elevation data (LiDAR) and updated floodplain maps to allow a more accurate assessment of vulnerable infrastructure resources
- Facilitate data sharing between agencies
- Investigate potential for changes in seismic activity
- State Revolving Fund (SRF) is a good "case study" to examine future financial assistance programs
- Important to have evolving standard design criteria that incorporate climate change
- Important to consider the lifetime of current infrastructure in strategy planning
- Consider decentralization as a strategy (esp. water management and energy)

Overlap with other Subcommittees

- Risks to public water supplies and resulting water quality issues are common concerns with the Human Health and Welfare subcommittee
- The use of natural infrastructure as a strategy overlaps with Natural Resources and Habitat
- Energy failures and price changes impact all sectors, particularly Local Economy and Coastal Zone and Oceans
- Insurance industry (Local Economy) may be able to act as incentives against building or rebuilding in flood-prone and other high hazard areas
- Climate change-induced damage of coastal infrastructure, including seawalls, bulkheads, piers, floats, and docks is a common concern with the Coastal Zone and Oceans subcommittee.

- A decentralized, natural stormwater management system could result in reduced floods, reduced energy demand from pumps, improved habitat, and reduced urban heat island effect

Overlap with GWSA Mitigation

- Stronger mitigation reduces the need for and level of adaptation
- Energy sector is likely to change based on mitigation plans
- A more decentralized energy system (e.g. small-scale use of solar PV panels and renewables) could help individuals adapt to larger-scale power failures

Key Infrastructure Subcommittee Participants

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Ed Kunce (co-chair)	Massachusetts Department of Environmental Protection
Ron Killian (co-chair)	Massachusetts Turnpike Authority
CCAAC Members	
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Subcommittee Members	
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AAC6 – Brief Overview from each Sub-Committee

LOCAL ECONOMY AND GOVERNMENT SUBCOMMITTEE

Chair: John Clarkeson, Massachusetts Executive Office of Energy and Environmental Affairs
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Sectors and Issues Addressed

- Tourism & Recreation
- Agriculture
- Insurance
- Commercial, Industry & Manufacturing
- Higher Education
- Health Care and Social Assistance
- Local Government, including Low-income and Vulnerable Populations
- Fisheries

Potential Vulnerabilities Identified

Sea level rise and flooding near rivers and streams

- Sea water infiltration to groundwater dependent drinking water supplies and irrigation a risk
- Impacts on coastal agriculture, notably aquaculture where farmed clam and oyster beds may no longer have the needed characteristics for production and where newer inundated ground may not be suitable as replacements.
- Impacts on coastal real estate, affecting land use decisions and infrastructure siting.
- Beaches may be subject to increased erosion
- Insurance rates, and in some cases underwriting decisions, are likely to be impacted.
- As the flood plains are re-mapped, there may be more existing properties found in floodplains zones triggering an expansion of flood insurance coverage (mandated by banks/voluntary desire for asset protection), a potential strain on household budgets.
- Impacts on transportation corridors to affect movement of workers, consumers, raw materials to places of production and finished goods to the market.

Higher Temperatures

- We may experience lower winter heating costs, but higher summer cooling costs
- We may see more ice storms in winter, which could interrupt business & municipal services
- Extended warm seasons are possible and could benefit tourism and agriculture. This could also, however, increase operation costs (labor and other fixed costs), and seasonal employment could shift to other labor pools as the schedules of traditionally seasonal labor pools are not likely to alter based on climate factors.
- Workers in outdoor industries (i.e. construction, public works) may find a heightened risk during heat waves, impacting productivity and construction costs; employee absences may increase; higher electricity bills to keep manufacturing plants comfortable for employees, and increased loads may result in the potential loss of power, thus affecting operations.
- Warming temps and increasing energy usage (and costs) could exacerbate mitigation efforts.

Precipitation

- Massachusetts' agricultural concerns have been active in promoting increasingly efficient use of water for many years, but irrigation demands can continue to rise as temperatures rise and the growing season is extended. Increased irrigation may also increase energy use in the agricultural community.
- Some southwestern states are already experiencing severe water shortages making Massachusetts an attractive place for water dependent industries to relocate.
- Introduction of climate change refugees into Massachusetts may occur. Competition for water between human needs for commercial and quality of life interests and eco-system needs could grow.
- A decrease in snow fall would affect winter recreation and water availability from decreased snowmelt in the spring.

Extreme Weather Events

In every sector (agriculture, commercial/industrial, tourism and recreation, and government) committee members discussed emergency planning. Focus could move beyond extreme weather events such as rain or ice storms, but also include new contingencies for extended heat waves and expanding risk to transportation routes and other infrastructure, prompting an increased demand on the amount as well as type of emergency supplies and personnel. These extreme events may also affect insurance rates and change underwriting decisions. Increased losses, resulting in higher premiums may force some underwriting firms to leave the market as returns will be better through other investments. Political pressure may be expected to put pressure on government to subsidize risk, keeping insurance costs low in affected areas. The end result may be taxpayer funds expended to underwrite higher risk behavior.

Common Themes and Data Gaps

- Using historical data for building codes, insurance costs, flood zones, etc. may not be adequate in planning for the future.
- Accurate elevation data, floodplain maps is sought. Updated elevation data could assist localities in better understanding areas at risk.

Overlap with other Subcommittees

Natural Resources and Habitat: Increases in temperature in lakes, rivers, streams and associated decrease in dissolved oxygen may affect fisheries and, therefore, impacting fishing. Additional pressure on viable water allocation programs to support sustainability is possible. Agricultural concerns have already been active in water supply management.

Key Infrastructure: Transportation systems, stormwater management, water supply issues all impact economies and government.

Human Health and Welfare: People choose to visit and/or live in Massachusetts, and the quality of life issues which attract them may change. One of the largest economic sectors in Massachusetts, health care is expected to face more pressure with extreme weather events such as flooding and heat waves.

Overlap with GWSA Mitigation: Mitigation strategies using regulation not only strives to reduce GHG, but provide a clear path to proper eco-system support and sustainability. Mitigation efforts may cause transportation costs to rise, impacting commercial shipping, food costs, and travel costs. There may be inequities in the impact on different demographic sectors of our population. Adaptive management may become a more viable model for decision making, since basing decisions on past experiences may no longer be valid.

Local Economy and Government Subcommittee Participants

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Brian Fairbank*	Jiminy Peak
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AAC6 – Brief Overview from each Sub-Committee

NATURAL RESOURCES

Co-Chairs: Jack Buckley, Division of Fisheries and Wildlife Email: jack.buckley@state.ma.us
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Sectors and Issues addressed

- Forests
- Wetlands
- Aquatic Habitats
- Landscapes
- Coastal Resources

Potential Vulnerabilities Identified

Forested Habitats

- Changes in species composition due to range shifts, increase in non-native invasive plants, and increase in native and non-native pests.
- Increased stress on native species from changes in mean and maximum air temperature and changes in water cycle.
- Increased threat from greater intensity and frequency of weather events.

Coastal Wetlands

- The main threat to coastal wetlands, particularly intertidal habitats is sea level rise.
- Catastrophic storm events could alter coastal habitats.
- Increased precipitation can alter the salinity regimes that maintain plant communities.
- Increasing freshwater flow may result in an increase of invasive species.

Aquatic Habitats

- Altered hydrology and habitat fragmentation can alter aquatic community structure and dynamics, disrupt migratory patterns and life cycles of aquatic organisms.
- Increased water temperature can increase vulnerability to invasive species and pathogens and pose a direct increased mortality of native populations.
- Increased surface runoff and nutrient loading can significantly impact water quality, lead to direct mortality of native species and lead to increased eutrophication.

Interior Wetlands

- Increased peak discharge can cause increased scour and erosion of adjacent wetlands reducing vegetative cover and wetland function.
- Increased temperatures in winter & related decreases in snowpack and ice can alter hydrologic processes.
- Increased temperature can increase stresses on native wetland species and alter competitive balance with non-native species.
- Increased temperature may result in the loss of isolated wetlands, bordering vegetated wetland and shortened hydroperiod of vernal pools.
- Decreased summer precipitation and drought are likely to result in overall drying of wetlands which would change system dynamics and species composition.

Landscape-scale Conservation

- Increased temperature, storm events and precipitation may result in interactive alterations in ecological processes at a landscape level that can have a significant impact on species distribution, natural community composition and ecological resilience of natural systems.

Common Themes and Data Gaps
Disruptions in ecological processes, loss of function, changes in species and natural community composition, invasive species and reduction in resiliency.

Overlap with other Subcommittees
- Coastal and Oceans on management and dynamics of coastal wetlands.
- Human Health relative to changes in abundance and distribution of species that are human disease vectors.
- Local Economy relative to degradation of natural systems and species that support tourism and recreation.
- Key infrastructure relative to the importance of natural systems as a cost effective solution to climate change impacts.

Overlap with GWSA Mitigation
Change in ecosystem dynamics can correspondingly change the capacity of natural mitigation (carbon sequestration)

Natural Resources Subcommittee Participants

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Heidi Davis	Massachusetts Department of Environmental Protection
Hunt Durey	Massachusetts Department of Fish and Game
Andy Finton	The Nature Conservancy
David Foster	Harvard University
Hector Galbraith	Manomet Center for Conservation Sciences
Gerard Kennedy	Massachusetts Department of Agricultural Resources
Wayne Klockner	The Nature Conservancy
Thom Kyker-Snowman	Massachusetts Department of Conservation & Recreation
Steve Long	The Nature Conservancy
Jim MacCartney	Trout Unlimited
Bernie McHugh	Massachusetts Land Trust Coalition
Anne Monnelly	Massachusetts Department of Conservation & Recreation
Bob O'Connor	Massachusetts Executive Office of Energy and Environmental Affairs
John O'Leary	Massachusetts Department of Fish and Game
Toni Pollack	City of Boston, Parks Department
Tim Puriton	Massachusetts Department of Fish and Game
Vandana Rao	Massachusetts Executive Office of Energy and Environmental Affairs
Caleb Slater	Massachusetts Department of Fish and Game
Jan Smith	Massachusetts Coastal Zone Management
Cassie Snow	Massachusetts Executive Office of Energy and Environmental Affairs
Lisa Vernegaard	The Trustees of Reservations
Lou Wagner	Massachusetts Audubon Society
Peter Weiskel	Department of Interior, United States Geographic Service

AAC7 – Outline of Final Report to the Legislature

CLIMATE CHANGE ADAPTATION - *Strategies for Massachusetts*

Annotated Report Outline

1. Title Page

2. Letter from the Secretary

3. Acknowledgements
   a. Brief paragraph acknowledging all those involved
   b. Include a list of Advisory Committee members
   c. Membership of the sub-committees (can also put this in the Appendix)

4. Table of Contents

5. List of Appendices, Tables and Figures

6. Executive Summary (2-3 pages)

7. Introductory Chapter (2-4 pages)
   a. What is climate change and how it is caused
   b. Global Scale (briefly):
      A brief history of how the global climate has changed over the last several thousands of years
      How the change has accelerated in the near past
      A brief description of Global projections – temperature, sea level rise, precipitation, and other more general qualitative changes
   c. Massachusetts:
      MA responsibility in cutting our emissions
      How climate change will impact the Northeast and MA
      Scenarios for the Northeast – observed and predicted climate change (an elaboration of the Scenarios document)
   d. The Global Warming Solutions Act and the climate change adaptation charge to EOEEA
   e. Definition of climate change adaptation
   f. The advisory committee and the framework/process of strategy development
   g. Public Engagement

8. Information and Data Needs (1-2 pages)
   a. Risk and Uncertainty
   b. General data, modeling, monitoring needs as identified by the subcommittees
   c. Include ideas/needs that cross-cut and are common to all the committees such as, updating flood maps, LIDAR
   d. General assumptions, principles of data gathering and modeling

9. Importance of Mitigation (1 page)
   a. The interaction between climate change mitigation and adaptation (in general). The mutual inclusiveness of both.

b. Description of how the climate change adaptation strategies identified in this report overlap with enhancing or reducing green house gases

10. Chapter on each subcommittee topic (~10 pages): Natural Resources and Habitat, Coastal Zone and Oceans, Local Economy, Key Infrastructure, and Human Health and Welfare. Each chapter will include the following:
    a. Introduction to the chapter:
       A brief description of this chapter, i.e. what it includes
       The types of sectors and subcategories
       How they interconnect
       The overall vulnerabilities
    b. A separate section on each sector. These sections will include,
       A brief description of the sector
       An inventory of existing resources, i.e. what currently exists
       A comparison of the inventory with the predicted northeast climatic changes
       An outline of the vulnerabilities
       Planning for the future, i.e. for new development, new projects, new approaches
       Outline of menu of potential strategies to address current and future vulnerabilities
       Ongoing efforts
       No regrets solutions / strategies what are considered good practice
       Short-term, Mid-Term, and Long-term strategies: each subcommittee defines the time frames depending on their respective planning horizons
       For each strategy, identify specific technical needs, identify overlap with other subcommittees, and indicate how the strategy affects (if at all) climate change mitigation.

11. Regional Considerations (1 page)
    a. What other New England states are doing
    b. MA coordination with our neighbouring states
    c. Specific strategies identified in this report that would benefit from a regional perspective

12. Conclusion
    a. Overarching strategies
    b. Overall approach and general preparedness
    c. Next Steps

13. References

Case Studies highlighting observed climate change impacts, extreme events and preparedness, local communities/efforts where CC is addressed will be put as a box in the different chapters

In addition, Graphs, Tables and Pictures will be interspersed throughout the document

AAC8 – Climate Change Adaptation Web page Overview

Climate Change Adaptation (CCA) Web Address:
http://www.mass.gov/dep/public/committee/ccaac.htm

The CCA website is generously provided and maintained by the Department of Environmental Protection and is accessible through the MassDEP homepage. The website serves as a parallel site to the other Global Warming Solutions Act committee, the Climate Protection and Green Economy Advisory Committee.

The CCA website provides a variety of information for the public including:

- Contact information for subcommittees
- Meeting schedules for both subcommittees as well as public information sessions
- Directions to public information sessions
- Allows committee members, workgroup participants, and the public at large a gateway to current climate change information through the posting of research materials

The committees have continued public awareness of the site the public information sessions, email interactions, etc.